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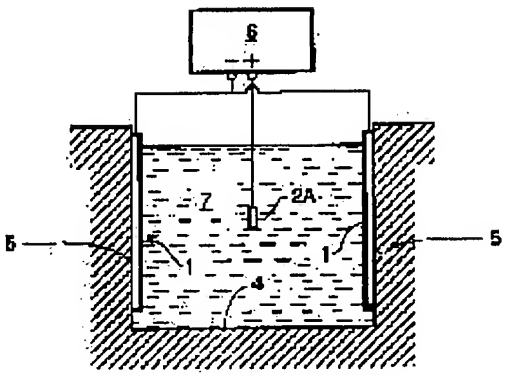
(54) ANTIFOULING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To enable a permanent and economical antifouling without contaminating an environment in an antifouling method preventing a sticking of a marine organism at a part contacting with the sweater on a surface of a marine structure, a seawater intake device of a ship.

SOLUTION: In this antifouling method, the surface necessitating the antifouling is coated with a conductive coating 1 having a composition in which a power or fiber of a conductive material selected from among a graphite powder, carbon black, metal powder and conductive fiber, a binder selected from among a thermoplastic



synthetic resin, thermosetting synthetic resin and natural or synthetic rubber and polyaniline are selected within the range of (20-90):(10-70):(1-40) by weight, and a direct current of ≥ 10mA/m2 per area of the cathode 1 is made to flow from a direct current power source device 6 provided separately between a counter electrode 2A made of an insoluble anode material by using the coating 1 as a cathode. An activated oxygen is generated at the surface of the cathode 1, and microorganism are sterilized with the activated oxygen and the sticking of a large-sized marine organism is prevented.

LEGAL STATUS

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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] the antifouling approach which consists of preventing adhesion of the marine organism to a cathode side by covering the conductive constituent which consists of the powder and (or) the fiber, binder, and the poly aniline of the conductive matter on the front face of the metal part which touches the seawater of the offshore structure, seawater intake works, or a vessel, and making it generate active oxygen for a direct current from a sink and a cathode side between counter electrodes by using this covering as cathode.
[Claim 2] the antifouling approach which consists of preventing adhesion of the marine organism to a cathode side by arranging the metal plate which covered the conductive constituent which consists of the powder and (or) the fiber, binder, and the poly aniline of the conductive matter, using this covering as cathode, and making the front face of the nonmetal part which touches the seawater of the offshore structure, seawater intake works, or a vessel generate active oxygen for a direct current from a sink and a cathode side between counter electrodes.
[Claim 3] as the powder and (or) fiber of the conductive matter, it is ****** from graphite powder, carbon black, metal powder, carbon fiber, and a metal fiber -- the antifouling approach of claims 1 or 2 carried out using a kind even if few.
[Claim 4] The antifouling approach of claims 1 or 2 carried out as a binder using what was chosen from thermoplastic synthetic resin, thermosetting synthetic resin and nature, or synthetic rubber.
[Claim 5] it is ****** in the range of 20-90:10-70:1-40 by weight about the blending ratio of coal of the conductive matter, a binder, and the poly aniline -- the antifouling approach of claims 1 or 2 carried out using a constituent.
[Claim 6] It is the antifouling approach of claims 1 or 2 which pass and carry out the direct current of the range of 30 - 200 mA/m2 preferably two or more 10 mA/m to the area of cathode.
[Claim 7] The antifouling approach of claims 1 or 2 which impress and carry out a direct current from the DC-power-supply equipment independently formed between a counter electrode and cathode.
[Claim 8] as a counter electrode, it is ****** from graphite, a manganese dioxide, and a platinum metal -- the antifouling approach of claim 7 carried out using an insoluble anode material.
[Claim 9] The antifouling approach of claims 1 or 2 which prepare a sacrificial anode, pass a direct current by the galvanic action between cathode and a sacrificial anode, and are carried out.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the so-called antifouling approach of preventing a marine organism adhering to the front face of the part which touches the seawater of the offshore structure, seawater intake works, or a vessel.
[0002]
[Description of the Prior Art] Painting an antifouling paint to a water boundary surface conventionally, or pouring in chlorine all over seawater as a means of antifouling which prevents that a marine organism adheres to the field adjacent to seawater, such as the offshore structure, has been performed. The coating of the type which makes an antifouling component ooze is a subject, and the antifouling paint painted to a water boundary surface also has the coating of the type to which elution of the stain proofing agents, such as a cuprous oxide, is carried out in a part.
[0003] A microorganism adheres to the front face of the offshore structure which is in contact with seawater first, the mechanism to which a marine organism adheres on the surface of the offshore structure forms a microorganism coat, following the order that large-sized living things, such as acorn shells, a mussel, and an oyster, adhere on it is known, and it becomes an effective solution to prevent adhesion of the microorganism to a front face.
[0004] The dosing method for pouring in chlorine and a hydrogen peroxide dulls the activity of the microorganism in seawater based on such a principle, and is widely adopted as an antifouling method.
[0005] A dosing method cannot be enforced as a matter of fact to the seawater which exists in infinity like the offshore structure, although it is convenient when aimed at a fixed water intake like antifouling of the circulating water system piping of an electric power plant. So, in such a case, the effective antifouling paint etc. is used only in the front face set as the object of antifouling.
[0006] The system which meant preventing propagation of a microorganism coat as an option and which is made to generate the chlorine in the spot is proposed. This approach is the approach of using an electrolysis electric conduction paint film of generating chlorine from a paint film front face, and preventing adhesion of a marine organism, by covering the field adjacent to seawater with the conductive paint film which mixed insoluble powder, such as graphite, carbon black, and a manganese dioxide, and electrolyzing seawater by making this into an anode plate (JP,63-101464,A etc.).
[0007] One person of artificers got to know that the poly aniline had the capacity as the so-called redox catalyst which takes an oxidation type and a reduction type reversibly by electronic transfer as shown in drawing 1 , consequently carries out the catalyst of the oxidation reduction reaction, invented the approach of sterilizing service water using this, and already indicated (Japanese Patent Application No. No. 3383473 [07 to]). It is thought that an operation of the poly aniline carries out the catalyst of the reaction which returns oxygen underwater and generates active oxygen, such as superoxide ion and a hydrogen peroxide, as shown in drawing 2 .
[0008] There are following un-arranging in the antifouling approach using an antifouling paint. that is, make it an elution mold -- an exudation mold -- an imitation -- the antifouling effectiveness will be lost

if the antifouling component contained in the paint film decreases. Therefore, it is necessary to carry out an apply substitute every two - three years, and a large amount of costs start whenever [the].
[0009] By the antifouling approach using the electric conduction paint film which generates chlorine, since making it acting as an anode plate and chlorine are generated, an electric conduction paint film is exposed to a very strong oxidation environment, and there is a possibility of deteriorating. Moreover, when applying to a structural steelwork, the cure against electric corrosion supposing degradation of an electric conduction paint film is required, and must protect a structural steelwork severely by the heavy anticorrosive paint. This means increase of the required number of coats, and is uneconomical.
[0010] Artificers checked that antifouling could be performed to the bottom of a reduction environment using this paying attention to the oxygen reduction ability of the poly aniline which returns oxygen and generates active species, such as a superoxide anion radical and a hydrogen peroxide, as a result of research.
[0011]
[Problem(s) to be Solved by the Invention] The purpose of this invention utilizes artificers' new knowledge mentioned above in view of the trouble of the conventional technique, does not have a possibility of polluting an environment, and is perpetual, and, moreover, the cure against electric corrosion is to offer the antifouling approach of unnecessary and economical seawater intake works.
[0012]
[Means for Solving the Problem] Theoretically, the antifouling approach of this invention is in-situ. It is the antifouling approach which is not exposed to the oxidation environment which is made to generate the active species of oxygen, prevents formation of a microorganism coat, prevents adhesion of a large-sized marine organism, and causes degradation of covering.
[0013] There are two modes in the antifouling approach of this invention. As one of them is the antifouling approach for the steel parts of the offshore structure like the bridge pier and quaywall which manufactured steel with the metal made into representation, and seawater intake works, various kinds of vessels, etc., for example, it is shown in drawing 3 It covers with the conductive constituent which becomes the inside of metal piping (3) from the powder or the fiber, binder, and the poly aniline of the conductive matter (1). It consists of preventing adhesion of the marine organism to a cathode side by generating active oxygen for a direct current from a sink and a cathode side between counter electrodes (2A) by using this covering as cathode.
[0014] Are, and as it is the antifouling approach for the offshore structure, a channel of seawater intake works, etc. which manufactured with the nonmetal material, for example, concrete, for example, is shown in drawing 4 , a paralysis convex Into the part which touches the seawater of the headrace made from concrete (4) which forms seawater intake works The metal plate (5) which covered the conductive constituent which consists of the powder or the fiber, binder, and the poly aniline of the conductive matter (1) is arranged. It consists of preventing adhesion of the marine organism to a cathode side by using this covering as cathode and generating active oxygen for a direct current from a sink and a cathode side between counter electrodes.
[0015]
[Embodiment of the Invention] Both of two approaches, the external power method currently performed to conductive covering by electrolytic protection as an approach of passing the electrical and electric equipment, and a sacrificial anode method, can be used.
[0016] An external power method will be an approach shown in drawing 3 thru/or drawing 6 , and if it explains taking the case of drawing 3 , it will be an approach of impressing a direct current from the DC-power-supply equipment (6) independently formed between the counter electrodes (2A) which covered the wrap metal plate (5) with conductive covering for the part which touches the seawater of a headrace, made this cathode, and were built with the insoluble anode material, in the object of antifouling, and here. As an insoluble anode material, the thing of daily use, such as graphite, a manganese dioxide, and a platinum metal, can be used.
[0017] Drawing 4 shows the seawater intake pipe which was used in the example which carries out a postscript and which lets seawater (7) pass. In this case, the counter electrode (2A) which performed

platinum plating to the titanium plate of a doughnut mold is used for a part for a flange. A sign (8) is insulating paint.

[0018] Drawing 5 shows the example which performs antifouling of a vessel. A direct current is passed from DC-power-supply equipment (6) between the counter electrodes (2) which insulated with conductive covering (1) painted to the body of a ship, and were prepared and which are immersed all over seawater (7). Drawing 6 shows the example of antifouling of a quaywall. Here, into the part which requires antifouling of a quaywall (9), the metal plate (5) covered with the same conductive covering (1) as drawing 3 is placed, this is made into cathode, and a direct current is passed from DC-power-supply equipment (6) between this and a counter electrode (2A).

[0019] A sacrificial anode method is an approach shown in drawing 7 and drawing 8 , prepares a sacrificial anode and passes a direct current using the galvanic action between cathode and a sacrificial anode. The seawater between cathode and a sacrificial anode serves as an electrolyte, a galvanic action breaks out, and a direct current flows.

[0020] Drawing 7 is the example which prepared conductive covering (1) in the inside of a steel seawater intake pipe (3), and established the sacrificial anode (2B) in the interior of a duct. On the other hand, drawing 8 is the example which prepared conductive covering (1) in the part which requires antifouling of the support column front face of a marine platform, and jutted out the sacrificial anode (2B).

[0021] The thing of arbitration can be used as the powder or fiber of the conductive matter. a practical thing is ****** from graphite powder, carbon black, metal powder, and conductive fiber -- they are things or those mixture. using the powder and (or) fiber of a metal especially iron, or steel as the powder or fiber of the conductive matter, when passing a direct current by the sacrificial anode method -- desirable -- as a sacrificial anode -- iron -- a less noble metal -- it is ****** from aluminum, zinc, and these alloys typically -- it is good to use a thing as an ingredient.

[0022] An organic high molecular compound is suitable for a binder. Although the formation approach of covering is arbitrary, it will usually prepare as a coating paint film, or will prepare as a lining, and a binder is chosen according to it. The rubber or plastics with which the thermoplastics and thermosetting resin which are generally used in coatings, and the high molecular compound of a rubber system are generally used for lining to a rubber lining or a resin lining again is used according to a conventional method for coatings.

[0023] The blending ratio of coal of the conductive matter under conductive covering, a binder, and the poly aniline is weight %, and is as good as ****** from the range of 20-90:20-70:1-40. it is good to make the above-mentioned ratio into the range of 30-50:30-50:5-20, when graphite and (or) carbon black are used as conductive matter, and when metal powder and (or) a metal fiber are used, it is good to make it the range of 15-40:50-85:1-20. If the conductive matter is blended at a high rate, the specific resistance of conductive covering becomes low, and although it is desirable, since a certain amount of strength is required of covering, the blending ratio of coal of a binder must also be secured to some extent. The poly aniline is required at least 1% or more, in order to obtain the work as a redox catalyst certainly. Preferably, combination use of the 3 - 20% is carried out.

[0024] Also in the antifouling approach of this invention, the active oxygen yield per unit area of covering increases like the usual electrochemical reaction in proportion to the current density of the direct current to energize. Although the current density more than a certain level is required in order to sterilize effectively and to obtain the antifouling effectiveness, extent which can sterilize a front face is enough as an yield, and there is no semantics which passes the current beyond the need. If it carries out from this viewpoint, two or more 10 mA/m current density is required, and what the current of the range of 30 - 200 mA/m2 should be preferably passed for was understood.

[0025]

[Function] The antifouling device of this invention sterilizes a microorganism in the field which is the same and touches the technique which passes a current feeble as an anode plate and carries out antifouling of the above mentioned chlorine generating electric conduction paint film in large semantics in the seawater of the offshore structure, seawater intake works, or a vessel, and, thereby, prevents

adhesion of a large-sized living thing. This invention uses conductive covering as cathode, reduction of the dissolved oxygen in seawater is made to generate active oxygen, such as superoxide ion and a hydrogen peroxide, to it having been a Prior art that a difference makes a chlorine generating electric conduction paint film act as an anode plate, and it is in using the germicidal action by this active oxygen. That is, by sterilizing the front face of seawater intake works by the active oxygen generated on that spot, it maintains at an always clean condition and adhesion of a large-sized living thing is prevented by it.

[0026] Since the microorganism close to the front face of conductive covering is only sterilized, the amount of the active oxygen made to generate for antifouling is very little, and antifouling by this invention is sufficient for it. A life is short active species, the residual toxicity does not become a problem and active oxygen does not affect an environment at all.

[0027]

[Example]

The manufacture following two sorts of a conductive paint of compounds were dissolved in the xylene solvent, and the conductive paint was obtained. : Example Example of a comparison Chloroprene rubber The 45 sections The 50 sections Graphite powder 45 50 Poly aniline 10 0 The "section" is the weight section.

[0028] The check above-mentioned two sorts of generation of active oxygen of conductive paints were applied to the separate steel plate, conductive covering was formed, they were made into cathode and a direct current was passed in the physiological saline by making platinum into a counter electrode. In the example which used the poly aniline, although what active oxygen generated in the cathode surface was checked, active oxygen did not generate in the cathode surface of the example of a comparison which does not use the poly aniline. Generation of active oxygen and its quantum were performed by the electrochemistry method.

[0029] By the service test following **, as shown in drawing 4 , many things which applied the conductive paint of an example to the inside of a steel pipe (3), and formed conductive covering (1) were connected, and the duct was formed. The titanium counter electrode (2A) and the steel pipe (3) were connected with DC-power-supply equipment (6). A direct current was passed with the current density of 40 mA/m2 in tubing, having used conductive covering as cathode for seawater with the sink by the 0.5m [/second] rate of flow. Seawater was poured on the same conditions as the corrosion-protective-covering steel pipe which applied the tar epoxy coating widely used for the anticorrosive coat for the comparison.

[0030] : which took out the test piece attached in the inside of two kinds of covering steel pipes, observed the number of the bacteria which adhered to the front face with the passage of time, and obtained the following result An example The example of a comparison The 1st day 1x103 or less 1x104 (unit: cells/mm2) The 2nd day 1x103 7x104 The 7th day 1x103 To the adhesion bacterial count on the front face of a test piece of the anticorrosive-paint covering steel pipe of the example of a comparison having continued increasing, the number of the bacteria adhering to the test piece on the front face of a steel pipe which performed antifouling according to this invention did not increase, but the clean front face was maintained as the days which poured 3x105 seawater increased. When long duration continuation of this trial was carried out further, to large-sized living things, such as acorn shells and a mussel, having begun to adhere to the anticorrosive-coat steel plate of the example of a comparison gradually, there is no adhesion of a living thing in the conductive covering steel plate of an example, and antifouling was realized.

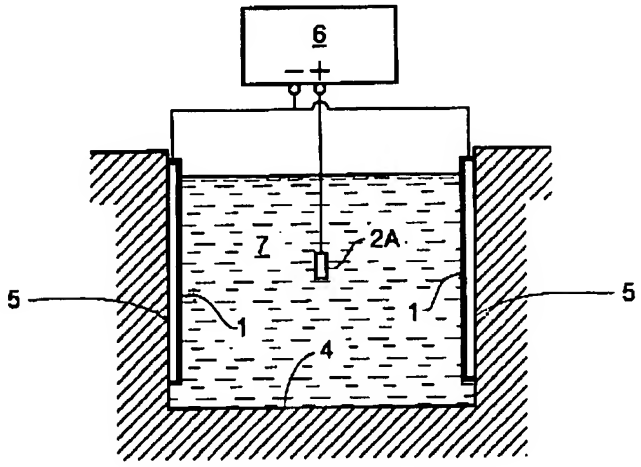
[0031]

[Effect of the Invention] If antifouling of the offshore structure, seawater intake works, or a vessel is performed by the approach of this invention, there are no worries about environmental pollution and adhesion of a marine organism can be prevented permanently. Since conductive covering of this invention acts as cathode, even when applying to steel piping, it is not necessary to perform insulating processing like antifouling by the conventional chlorine generating electric conduction paint film, and can apply directly, and, moreover, there is no concern of electric corrosion. Therefore, since antifouling

of this invention can be used together with the electric anticorrosion generally adopted as seawater intake works etc., it can carry out antifouling and corrosion prevention economically to coincidence.
[0032] Since it does not become the ambient atmosphere of the acidity produced when the seawater of the covering circumference means becoming alkalescence and uses a chlorine generating electric conduction paint film, and an oxidizing quality that conductive covering is cathode, there is little degradation of covering and a marked difference comes out of it to the endurance of covering. Since the poly aniline under conductive covering does not act as a catalyst of an active oxygen generation reaction and it is not oozed out or eluted all over seawater like the component of an ordinary antifouling paint, the operation is permanent. Therefore, a repaint and spacing of re-lining are made for a long time, and are economical also from this point.

[Translation done.]

Drawing selection Representative drawing



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